Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Shear turbulence, Langmuir circulation and scalar transfer at an air-water interface AMINE HAFSI, ANDRES TEJADA-MARTINEZ, University of South Florida, FABRICE VERON, University of Delaware — DNS of an initially quiescent coupled air-water interface driven by an air-flow with free stream speed of 5 m/s generates gravity-capillary waves and small-scale (centimeter-scale) Langmuir circulation (LC) beneath the interface. In addition to LC, the waterside turbulence is characterized by shear turbulence with structures similar to classical "wall streaks" in wall-bounded flow. These streaks, denoted here as "shear streaks", consist of downwind-elongated vortices alternating in sign in the crosswind direction. The presence of interfacial waves causes interaction between these vortices giving rise to bigger vortices, namely LC. LES with momentum equation augmented with the Craik-Leibovich (C-L) vortex force is used to understand the roles of the shear streaks (i.e. the shear turbulence) and the LC in determining scalar flux from the airside to the waterside and vertical scalar transport beneath. The C-L force consists of the cross product between the Stokes drift velocity (induced by the interface waves) and the flow vorticity. It is observed that Stokes drift shear intensifies the shear streaks (with respect to flow without wave effects) leading to enhanced scalar flux at the air-water interface. LC leads to increased vertical scalar transport at depths below the interface.

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Date submitted: 01 Aug 2016 Electronic form version 1.4